REMARKS

By this amendment, claims 1-6 and 14 have been amended; claims 1-21 are pending; claims 1, 5-7 and 11-13 stand rejected as anticipated by *LeBlanc*; claims 2-4 and 8-10 stand rejected as obvious in view of *LeBlanc*, *Henningsen* and/or *Cizmer*, and claims 14-21 were withdrawn from examination due to a restriction requirement. Further examination of the application, as amended, withdrawal of the restriction requirement, and reconsideration of the rejections are respectfully requested.

No New Matter

Claims 1 – 6 have been amended to emphasize that the cooling of the partial oxidation (POX) reactor effluent occurs upstream from the reforming exchanger. Support for this clarification is found, inter alia, in original claim 1, in original paragraphs [0007] to [0009], and [0015] to [0017] of the specification, and in Fig. 2 as filed.

Restriction Requirement

The Office Action imposed a restriction requirement between syngas preparation method claims 1-13; "means for" 112/6 apparatus claim 14; and syngas retrofit method claims 15-21. Applicant hereby confirms the provisional election of claims 1-13 for examination, with traverse.

Claim 14 has been written using the "means for" terminology of 35 U.S.C. §112, 6th paragraph, making this claim a linking claim that recites a means for performing each of the process steps recited in claim 1. "Means for" linking claims must be joined with mirrored process claims as stated in MPEP 806.05(e): "If the apparatus claims include a claim to 'means' for practicing the process, the claim is a linking claim and must be examined with the elected invention. If it is ultimately allowed, rejoinder is required. See MPEP Section 809.04." Thus, the examiner must examine linking claim 14.

A retrofit claim such as 15 is normally classified as an apparatus claim. However, method claim 15 uses the alternative "step for" terminology of 35

U.S.C. §112, 6th paragraph, also making this pseudo-apparatus claim a linking claim that recites a step for achieving the results recited in the elements of claim 1, or an equivalent thereof, such that the searching required for examination of claims 15-21 would not be significantly different than that required for the method and apparatus of claims 1-14. Thus, the Office Action does not show that there would be a serious burden imposed without restriction. See MPEP 803. Withdrawal of the restriction requirement and rejoinder of claims 14-21 are respectfully requested.

§ 102 Rejections

By way of background, the present invention uses a reforming exchanger in combination with a partial oxidation (POX) reactor in a new hydrogen plant with improved efficiency and reduced steam export, or in an existing hydrogen plant. The hydrogen capacity can be increased by as much as 20 to 30 percent, with reduced export of steam from the hydrogen plant. The process includes: (a) partially oxidizing part of the hydrocarbon feed with oxygen in a POX reactor; (b) cooling the POX reactor effluent to 650° - 1000°C; (c) feeding the cooled POX reactor effluent to a reforming exchanger or 'KRES unit'; (d) passing a second part of the hydrocarbon feed with steam through a catalyst zone in the KRES unit; (e) mixing the KRES reactor effluent from the catalyst zone with the effluent from the POX reactor; (f) using the admixture in the KRES unit to heat the catalyst zone; and (g) collecting the admixture from the KRES unit. The apparatus employs a means for each of these operations, and the retrofit method employs generally corresponding steps. See claims 1, 14 and 15.

The cooling, part (b), can include introducing water into the first reactor effluent as a quench fluid (see claims 2, 16), indirect heat exchange (see claims 5, 6, and 17), or a combination of water quenching and indirect heat exchange (see claims 3, 4, and 19). The indirect heat exchange can be used to preheat the second hydrocarbon portion in a cross exchanger (see claims 4, 6, and 18). The temperature of the reformer catalyst tube effluent gas is desirably as hot as

the materials of construction of the reforming exchanger will allow, e.g. from 750° to 1000°C in the standard KRES unit, where the heat is supplied by the combined effluents of the POX reactor and the reforming exchanger (paragraph [0017]). Thus, the temperature and rate of the cooled POX reactor effluent must not be such that the temperature of the reforming exchanger will exceed the design parameters.

Leblanc discloses a KRES-type reforming exchanger used with a catalytic exothermic steam reforming reactor, referred to in the art as an autothermal reformer. In contrast, the present invention utilizes an unpacked, non-catalytic, usually smaller POX reactor producing a much hotter effluent that is not disclosed or suggested anywhere in *LeBlanc*. Additionally, the flow configuration as claimed in the present application cools the effluent from the first reactor upstream from the KRES unit, a step which is nowhere seen in *LeBlanc*. *LeBlanc* thus fails to anticipate any claims of the present application.

The presently claimed POX reactor and the LeBlanc autothermal reformer are different in operating conditions (catalyzed/non-catalyzed, temperatures, etc.), feed compositions, product compositions (relative proportions of CO, CO_2, H_2, and in the amount of carbon or soot produced), etc., and applicant's use of direct and/or indirect heat exchange to cool the POX reactor effluent indicate that there can be no equivalence between the two very different reactors. The LeBlanc process as disclosed would not work simply by substituting a POX reactor for the autothermal reactor, and there is no motivation, suggestion or guidance to even try this, let alone an expectation of success in doing so. The office action correctly notes that "*LeBlanc* discloses that the exit temperature of the exothermic catalytic steam reformer is preferably between 900°C and 1100°C, thus demonstrating that the first reformed effluent would have a cooled temperature within the range from 650°C to 1000°C after the first gas formation." However, this would overlook the requirement for the cooling to the stated temperature to be effected upstream from the second reactor. Moreover, the

clear teaching of LeBlanc to use the mode of operating the first reactor as a means of controlling the effluent temperature is directly contrary to applicant's claimed process wherein the first reactor effluent is subjected to a distinct cooling step.

To form a proper 102(b) rejection, the prior art reference must explicitly or implicitly disclose each element in the specific manner claimed by applicant. *LeBlanc* shows neither the reactor claimed nor the cooling step as specified, and thus a 102(b) rejection of claim 1 with respect to *LeBlanc* is not proper. Similarly, dependent claims 2-13 likewise include the limitations of claim 1, and are likewise not anticipated by *LeBlanc*.

§ 103 Rejections

As shown above, *LeBlanc* does not teach each element in claim 1. The secondary references, *Henningsen* and *Cizmer*, likewise do not teach or suggest either a POX type reactor or cooling upstream from the KRES unit, and thus fail to bridge the gap between *LeBlanc* and claim 1. As such, a prima facie case of obviousness can not be established, as the purported combination of these references does not result in all the claim limitations. Moreover, even if it did, no suggestion or impetus to combine the references in this manner can be found in the references relied upon.

Henningsen discloses contacting syngas with quench water to cool the syngas, but like *LeBlanc,* does not teach the use of a POX reactor and the subsequent cooling step(s). Neither *Henningsen* nor *LeBlanc* teach or suggest that the proposed quench should be used in combination with the POX reactor and the KRES reformer-exchanger as disclosed by applicant. As a result, the proposed combination of *LeBlanc* and *Henningsen* does not teach or suggest all of the elements of claim 1 or claims 2-4, and the rejection under 35 U.S.C. § 103(a) should be withdrawn.

Referring to claim 4, the cross exchange, as described in paragraphs [0009] and [0015] of the specification, occurs when cooling the POX effluent by

preheating the feed supply for the KRES catalyst tubes. The cross exchange does not refer to the heat exchanged within the KRES, thus the rejection of claim 4 is improper.

Cizmer discloses a KRES-type reformer-exchanger wherein the tubes are adapted to hold catalyst therein and allow passage of reactant fluid, but again like *LeBlanc,* does not teach the use of a POX reactor and the subsequent cooling step(s) in the specified flow configuration. The rejection under 35 U.S.C. § 103(a) is improper and should be withdrawn.

During the course of these remarks, Applicant has at times referred to particular limitations of the claims which are not shown in the applied prior art. This short-hand approach to discussing the claims should not be construed to mean that the other claimed limitations are not part of the claimed invention. Consequently, when interpreting the claims, each of the claims should be construed as a whole, and patentability determined in light of this required claim construction. Unless Applicant has specifically stated that an amendment was made to distinguish the prior art, it was the intent of the amendment to further clarify and better define the claimed invention.

If the Examiner has any questions or comments regarding this communication, he is invited to contact the undersigned directly to expedite the resolution of this application. Further examination of the application and reconsideration of the claims as originally presented and the allowance thereof is respectfully requested.

Respectfully submitted,

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